

## **The Northeast Center for Occupational Health and Safety: Agriculture, Forestry and Fishing**

Summary Annual Report  
Fiscal Year 2014

NIOSH Center Grant  
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Submitted by:  
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## Section I

### Center Summary

The Northeast Center (NEC) is a NIOSH funded extramural Agriculture, Forestry and Fishing (AFF) Research Center, which is affiliated with the Bassett Healthcare Network in Cooperstown, NY. The mission of the NEC is to enhance the health of AFF workers by identifying priority health and safety issues and working with AFF communities and stakeholders to identify prevention solutions. The Center provides these services to an eleven state region that extends from Maine all the way to Maryland. Over the past year, NEC activities have largely focused on moving the six R01-type projects to the right of project logic models. The Center's evaluation team has also worked diligently to insure fidelity to project timelines and to share high impact outcomes with NIOSH and AFF communities. The Center's major projects are evenly divided between Research, Intervention/Prevention and Education/Translation. These projects and Principal Investigators represent considerable expertise in engineering, occupational medicine, public health, social science, evaluation and education. Several mini-grants have also been funded over the past year and have expanded NEC's knowledge of emerging issues and novel research and intervention methods. These efforts capitalize on long-established partnerships with agencies and other health research institutions in the Northeast, such as Harvard University, Pennsylvania State University, Yale University, the University of Massachusetts: Lowell, the University of Vermont, Farm Bureau, State Departments of Agriculture, Labor and Health, the National Oceanic and Atmospheric Administration, the U.S. Coast Guard and the Sea Grant Program.

In addition to its NIOSH Center funding, the NEC has benefitted in 2014 from two additional NIOSH research grants, a R01 and a R21, both aimed at addressing tractor-related injury and fatality. The NEC also successfully leverages NIOSH support from other funding agencies in excess of \$1.2M.

#### *Center Aims and Priorities:*

<b>Priorities</b>	<i>Maximize Center Resources</i>		<i>Research to Practice</i>	<i>Emphasize Impact</i>	
<b>Aims</b>	#1-Improve Surveillance to identify priorities	#2-Focus on Vulnerable and High-Risk Workers	#3-Move proven prevention strategies into workplaces	#4-Reduce traumatic injuries in Ag, Forestry, Fishing	#5-Reduce traumatic deaths in Ag. Forestry, Fishing

### Relevance

AFF workers have a significantly higher risk of occupational death and injury than workers in other U.S. industries. However, addressing these issues in the Northeast is particularly challenging due to the considerable diversity in AFF work environments and populations. As a result, NEC activities have largely focused on identifying and monitoring risk factors, in order to develop multiple strategies for addressing them. In the area of farm and forestry safety and health, a surveillance system is being developed to capture both injury and fatality data from multiple sources. This information is being used to prioritize intervention and outreach activities and to strategically develop partnerships within the community that can help to address priority health issues and identify emerging issues.

In addition to surveillance, NEC activities have focused on different facets of the injury process, from education on risks, to interventions that mitigate risks (i.e. increasing access to safety products, working with manufacturers to improve safety designs and equipment, developing standards for safer working conditions, conducting on-farm safety audits, promoting the use of safety products, etc...), to strategies for improving outcomes should injuries or illnesses occur (i.e. first-aid training, case-management and treatment, provider occupational health training, tailored to agricultural issues). Similar activities are also being conducted in the area of fishing and forestry safety, with the aim of reducing injuries and illnesses and improving outcomes for those injuries and illnesses that do occur.

## Key Personnel

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## **Section II**

### PROGRAM HIGHLIGHTS

#### Center-Wide Activities

During the reporting period, the NEC has made significant progress in fulfilling its specific aims and overseeing core activities. In May 2013 and October 2013, the NEC Scientific Advisory Panel was convened for meetings in Washington DC. In October 2014 the NEC Fishing Advisory Panel will meet in New Bedford, MA. In November 2014, the NEC Scientific Advisory Panel will meet again in Washington DC to review NEC research projects and discuss NEC priorities for the next funding cycle. These meetings continue to be very valuable to NEC administration and researchers as an opportunity for ongoing advisement on current NEC projects and activities and to insure that this research is responsive to the needs of AFF workers.

On September 24 and 25, 2014, the NEC annual meeting was held in Saratoga Springs, NY. Researchers from each of the six, funded scientific projects and six of the feasibility projects were in attendance. Attendees presented their projects at a poster session, and as brief oral presentations. The presentation format was limited to five slides which served to summarize project activities, publications, outputs, outcomes and next steps for translating AFF research into practice (R2P). The R2P topic stimulated considerable discussion after each presentation and was very helpful for exploring R2P challenges. In addition to presentations, a group brainstorming activity was conducted to address the following questions:

- *What are the biggest barriers to progress in tackling AFF occupational safety and health issues in the Northeast?*
- *How can we move NEC AFF research into practice?*

This meeting promoted an in-depth discussion on barriers to progress and also generated several helpful suggestions that NEC staff will review and attempt to incorporate in future Center activities. Participants were also asked to rate the annual meeting using various measures on a three-point scale (3="very well"; 2="well"; 1="not well"). Participants reported an average rating of 2.7 on facilitation of discussion, 2.7 on participation, 2.7 on networking and 2.3 on support for planning future research.

### *Program Changes:*

*The NEC name and logo has changed and is now: The Northeast Center for Occupational Health and Safety: Agriculture, Forestry & Fishing*



### Changes in Personnel

Julie Sorensen has succeeded John May as Center Director. John May will serve as the Center's Deputy Director.

### Presentations and Publications

Over the past year, six presentations have been made (or accepted for presentation in 2015) at national epidemiology, safety and health conferences. There have been three manuscripts published or accepted for publication in the peer-reviewed literature and six manuscripts in progress. See **Table 1. Scientific Project Outputs and Intermediate Outcomes** and **Table 2. Dissemination of NEC Project Results** at the end of this report for a detailed listing of publications and presentations.

### **Outreach**

Outreach is an important component of NEC injury prevention activities and includes safety training and education, health screenings and promoting the use of personal protective equipment (PPE) for AFF workers. A group of NEC "regional trainers" are employed to provide safety expertise and support to farmers in a number of northeastern states. Safety trainings consist of on-farm consultations with farm managers, on-farm worker safety trainings, and off-farm educational presentations to youth, farm owners, and farm service organizations. New approaches to training include working with a refugee center and presenting ergonomic topics for preventing muscle injuries.

This year there were 71 on-farm consultations, 155 safety trainings in English for 1,309 workers, 202 safety trainings in Spanish for 2,017 workers, and 38 educational sessions reaching 1,609 workers, owners and farm professionals. A majority of this work has been concentrated on dairy farms in New York since the announcement by OSHA that there would be random safety inspections on these farms.

Logging safety classes are also offered to farmers and land owners who have varying levels of logging expertise. This year 14 'Game of Logging' classes were offered on the following topics: chainsaw handling, use of proper protective equipment, and safer felling practices. 115 individuals participated in these trainings. Trainings were evaluated using pre- and post-training tests, as well as direct observation. Trainees were also scored on their chainsaw handling performance and felling practices. Evaluation results were used to fine tune subsequent trainings.

Outreach activities have also encompassed attendance at trade shows, provision of technical assistance, as well as promotional activities which include print publications, radio spots and internet/social media updates. Trade shows are a major avenue for making farmers aware of the NEC services that are available to them. These services include the ROPS Rebate Program, On-farm services such as trainings and safety and audits, and the Farmer's Occupational Health Clinic. A mobile trailer outfitted for health screenings, is also featured at various trade shows and farmer attended events. This year the type of services offered

included skin cancer screenings (3), blood pressure (2), vision (2), and hearing (2). Strategies for increasing the use of PPE on farms include: providing high quality affordable PPE at trade shows, at the farms, and opportunities for ordering supplies through a catalog. This year about \$48,000 worth of PPE was sold to over 215 customers. Farms can also request respirator fittesting for their workers by coming to an event where the service is being offered or having it done on their farm. Seven farms requested fit-testing on site for 46 workers. Some of these activities were directly supported with NEC outreach funds and some leveraged with other funding sources.

Lastly, 17 articles were published in farming publications covering topics of current interest (for example, Dairy Safety was emphasized this year).

## **Research Core**

### The New Surveillance Strategy for Farming and Forestry Injury Project

Analysis of Maine and New Hampshire data allowed researchers to become familiar with the nuances of each data source. Using narrative sections of ambulance reports has proven extremely valuable in understanding mechanisms and contributing factors to farming and forestry injury events. The notable lack of duplication of injury events across two sources of data (ambulance reports and hospital data) has underscored the importance of using several data sources. For example, in Maine, only three injury events were found in both sources of data where both records contained a farm/forestry variable.

Plans for the coming grant year include importation of final data to maximize generalizability to the largest possible geographic area and longest possible time-span. Time-trend and seasonal variation analyses are planned, and cumulative incidence will be calculated using Census of Agriculture/American Community Survey population estimates as denominators. Dissemination of results is planned to each of the participating states through various channels, including state health departments, state EMS agencies, and the NORA Forestry Sector Council. Longer term future plans include using the developed surveillance system to evaluate intervention programs, identify emerging issues in agriculture and forestry occupational health, and to incorporate the valuable expanded E-Codes included in the ICD10 transition into surveillance efforts.

Beyond Maine and New Hampshire, data acquisition has varied from state to state, and the process of securing additional data continues. A manuscript summarizing the injury data from Maine has been provisionally accepted to the *Journal of Agromedicine* (title: "Estimation of Agricultural and Logging Incidence in Maine Using Electronic Administrative Data Sets"). Other outcomes achieved or expected during the course of this project are the improved granularity in definition and description of events (through narrative fields on ambulance reports), a finalized keyword search algorithm, the ability to detect dispersion/trends in events through the use of control charts and the ability to summarize episodes of care, as well as distribution of payer information.



*States in the Northeast that are participating in the multi-state surveillance effort are shaded in gray.*

#### Musculoskeletal Disorder Rates in Northeast Lobster Fishermen

This surveillance research project is designed to impact a national effort to understand regional variations in exposures and outcomes in commercial fishing. NIOSH has done exemplary work in the general fishing industry with the practical purpose of preventing fatalities, injuries and illnesses to fishermen. Until recently, however, denominators have not been reliably collected in this country. The NEC is fulfilling a regional need for estimating injury and fatality rates among lobster fishermen; data that have not been previously captured by NIOSH, because it is mostly state regulated.

This four year prospective study will quantify work exposure (FTE) by specifically estimating the denominator population in man-hours, of the lobster-harvesting sector. In addition, the Nordic questionnaire is being used to measure the prevalence of musculoskeletal injuries and the body segment injured. Data are being collected by phone every three months from a cohort of 274 lobster boat captains. These phone surveys allow lobstermen to report any acute injuries over the previous months. Data are also being collected in face to face interviews, from captains and crew members, once per year. In these interviews, researchers seek to quantify aches and pains that may be indicative of non-acute injuries and chronic musculoskeletal disorders.

Data collection is proceeding on schedule and includes 141 boats in Maine and 133 boats in Massachusetts. Quarterly calls to the full cohort have been completed for two full years of follow-up. In addition, 268 of the active 274 subjects in the cohort have been interviewed face-to-face, at least once and 176 of the active 274 subjects have been interviewed twice. Current results support the hypothesis that the lobstering sector has a comparably low fatality rate, and point to specific body segments (wrist, hand, shoulder and back injuries) of individuals in the population that are associated with increased risk for injury. In Maine, the FTE exposure estimate is about 45% higher than in Massachusetts and was particularly high in Quarter 3. Qualitative data has already offered a valuable glimpse into important health and community concerns that lobstermen are facing, namely the lack of ergonomic advice or guidance in the health care system. These outcomes are vital to shaping future work in reducing outcomes of injury and illness for lobster fishermen. Study results have been disseminated at the Maine Fisherman's Forum. Next steps include completing two papers in process and submitting them for publication. Questions about ACA health insurance coverage may be added to quarterly surveillance to assess coverage. Intervention ideas are being developed. One is the subject of a current feasibility study, i.e. evaluation of the ergonomics of a foot operated lobster banding tool that is designed to reduce wrist and hand stress. This tool may also increase productivity as the two claws can be banded at the same time.



## **Intervention/Prevention Core**

### Farm Tractor Stability Systems

The leading cause of occupational fatalities on U.S. farms is farm tractor accidents, more than half of which involve tractor rollovers. While ROPs are extremely useful in preventing or reducing injury when a farm tractor rolls over, the project researchers are investigating the human factors and engineering issues associated with preventing farm tractor rear and side overturns in the first place. To accomplish the project goals, the research team completed a farm tractor simulator with a 6-axis motion base, a 360 degree visual display, and an 8000 series John Deere tractor cab. Continual improvements are being made to the tractor simulator that will allow the tractor to be tilted at larger angles. The simulator is being used to safely evaluate tractor operator behavior and perceptions when confronted with dangerous overturn or near-overturn scenarios. The researchers evaluated tractor operator visual scan patterns in a natural setting to determine the best location to mount a stability display system (tractor operator interface) that will be developed in later tasks. The interface has been evaluated in the farm tractor simulator under rollover and near rollover scenarios to determine the optimal type of information to give operators who are in danger of rolling their tractors. Researchers plan to develop an alert system for side overturn prevention and to use an active intervention i.e. power cutoff to prevent rear overturn. An obstacle course will be developed to test these interventions. The alert system is being developed to overcome human factors thus visual, auditory and haptic alerts are being developed and most likely all three will be combined in the final model. The alert system will also be expanded to incorporate the operator's condition i.e. fatigue detection and the operator's position in and around the tractor. Thus the simulator can be used as a test bed for autonomous systems.

Industry partnerships have been developed that include John Deere, which donated a new tractor cab to use on the simulator, and Volvo, which invested \$100,000 for this research. The open source simulator system will be moved to the new Agricultural Engineering Building at Pennsylvania State University.

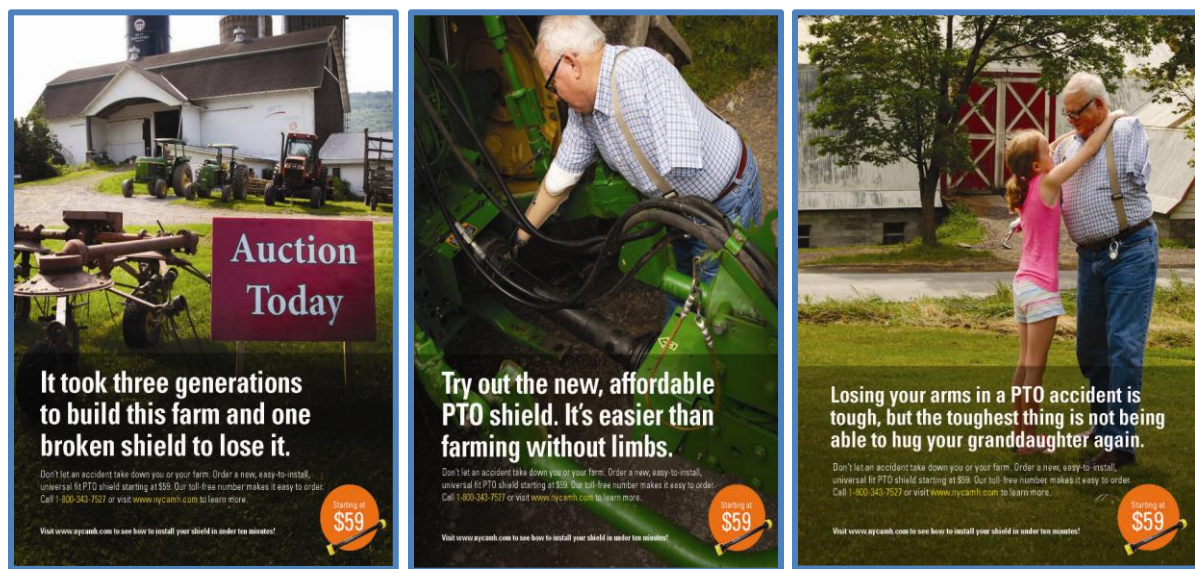
Study results were presented at the American Society of Agricultural and Biological Engineer's (ASABE) meeting in Montreal in July 2014. Data collection will continue during the autumn months to supplement current data. A publication related to this work "Perceptions of tilt angles of an agricultural tractor" was published in the *Journal of Agromedicine*. A state of art review manuscript is in progress.

### Social Marketing of Machinery Safety Shields

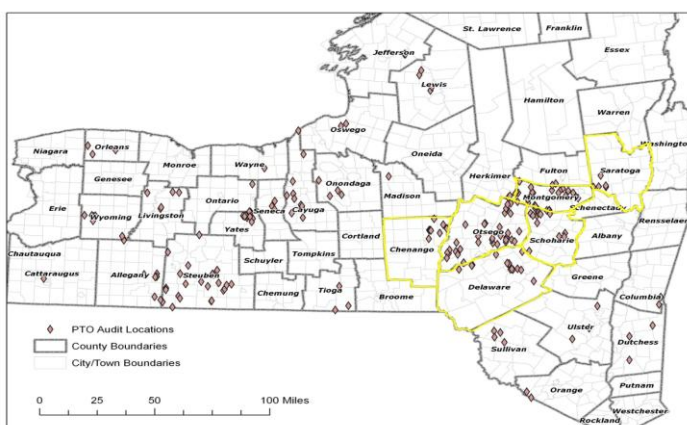
Machinery entanglement incidents are unfortunately a relatively common cause of farm fatalities and serious injury in the Northeast. Detailed fatality data for New York and Pennsylvania (representing 66% of the Northeast farm population) indicate that machinery entanglement fatalities are among the top three causes of death. Fortunately, the installation of power-take off (PTO) shielding can considerably reduce, if not eliminate the risk of injury or death from PTO entanglements.

Using an intervention framework that has proven successful for increasing the installation of ROPS on unprotected tractors, project researchers have laid the groundwork for launching a PTO social-marketing campaign in New York. A telephone survey conducted during the first year of the project suggested that 90.2% of PTO drivelines in New York are adequately shielded. To assess the accuracy of this survey and confirm the proportion of adequately shielded PTO drivelines, a series of 211 on-farm audits were completed. Audits began in the end of year one, and were completed at the beginning of year two. In total, 1,470 implements were examined during these audits; only 57% of the PTO drivelines were adequately shielded.

In addition to on-farm audits, focus groups were conducted with New York farmers to identify favorable messages to be used in the social-marketing campaign. The three finalized messages are shown below. The six-month PTO shielding campaign will begin in the fall of 2014. The manuscript "Concept Identification for a Power Take-Off Shielding Campaign" was accepted for publication in August 2014 in the *Journal of Agromedicine*. An additional publication entitled "Validation of Self-Reported Power Take-Off Shielding Using On-site Farm Audits" is currently being reviewed by the Journal of Agricultural Safety and Health.



*Finalized Social Marketing messages for machinery safety shields (PTO).*



Plans for the next funding year include launching the social marketing campaign, a six-month campaign that will deliver messages in various media channels in six New York counties. In addition, follow-up audits will be conducted with participants from the audit study.

*Target area of New York State for dissemination of PTO social marketing messages outlined in yellow.*

## Education/Translation Core

### On-Line Tool for Designing Ventilation Systems to Reduce Manure Pit Entry Risk

Design and installation of the designed pits greatly reduces worker exposures to toxic and asphyxiating gases when entering these pits. In 2014, the research team finalized the development of a user-friendly on-line tool for designing manure pit ventilation systems. The interfacing pre-processing and post-processing software which allows the on-line tool user to input project data to access ventilation system performance data from the main simulation program have been finalized. A wider range of manure pit configurations were incorporated into the on-line tool. Alpha and Beta testing are complete. Beta tested modules involved 11 national Agricultural engineers and manure facility planners and was completed on 9/12/14. The on-line tool version 1.0 was launched on September 23, 2014 at <http://www.engr.psu.edu/ventilationdesign>.



Publication of this work includes: Murphy, D.J. and H. B. Manbeck. 2014. Confined Space Manure Storage and Facilities Safety Assessment. *Journal of Agricultural Safety and Health* 20(3):199-210. A user's manual is also on the Penn State website. The study results were presented at the 2014 ASABE conference in Montreal.

Future plans include collecting information about users who sign in, developing a plan to maintain the Online Tool, publicize and market it, and developing a training program most likely using a webinar format. Follow-up surveys to measure use of the Online tool and adoption on farms is not feasible in Year 5 and needs to be done after there is evidence of adequate dissemination.

#### Northeast Fisheries Winch Safety Improvement Project

The objectives of this study are to design a mechanical device to enhance safety and introduce and disseminate training on and use of this device to the fishing community. This study will employ social marketing protocols to share good administrative controls/practice currently used in the fleet.

In order to describe common winch configurations utilized in the Northeast fishing industry, 54 captains were surveyed in the ports of Gloucester and New Bedford in Massachusetts, and Point Judith in Rhode Island.

Survey results showed that 100% of those surveyed, had winches that were hydraulically powered. Of the 89% of survey respondents who reported having a PTO (shut-off switch) on board, 39% reported that these shut-off switches were more than one arm's length away from the winch operator, thus not ensuring immediate winch shut-down capability in the event of an accident. Survey data showed that the hazardous manual level wind technique is used when the winch is located on mid deck. Because 90% of the captains reported that they do not employ hydraulic level winders (HLW) on their vessels, there is no clear need for a newly designed HLW.

A design for an emergency stop switch will be built as either full scale prototype or ½ scale for demonstration in the coming grant year. A local marine engineer has been identified to do this. A sea trial will also be conducted on a boat in Rhode Island.

Two completed focus groups have identified a cost barrier for hydraulic level winder as the estimated cost is \$2,600 to \$3,000 if the fisherman installs the unit himself. However the cost would likely be offset because this device frees up crew, reduces potential injury and increases productivity. The question of the economic, injury prevention and ergonomic advantages of emergency stop switches and winch design should be addressed in future studies as such analysis could be used to promote adoption if the cost analysis is favorable.

Two additional focus groups are planned for year 5 to gain additional information on the level of interest in and design preferences for PTO and emergency stop switches. Two non – peer reviewed publications have been produced.

#### **Evaluation Core**

Most noteworthy accomplishments for the Evaluation Core in 2014 include:

- 1) identifying the need for and planning economic analyses
- 2) collaborating in proposal development for the next funding cycle
- 3) maintaining clear logic models for the NEC and individual R01 projects tracking of all projects (outputs, impacts, and progress relative to timeline)
- 4) evaluating the Annual Meeting of scientific project investigators

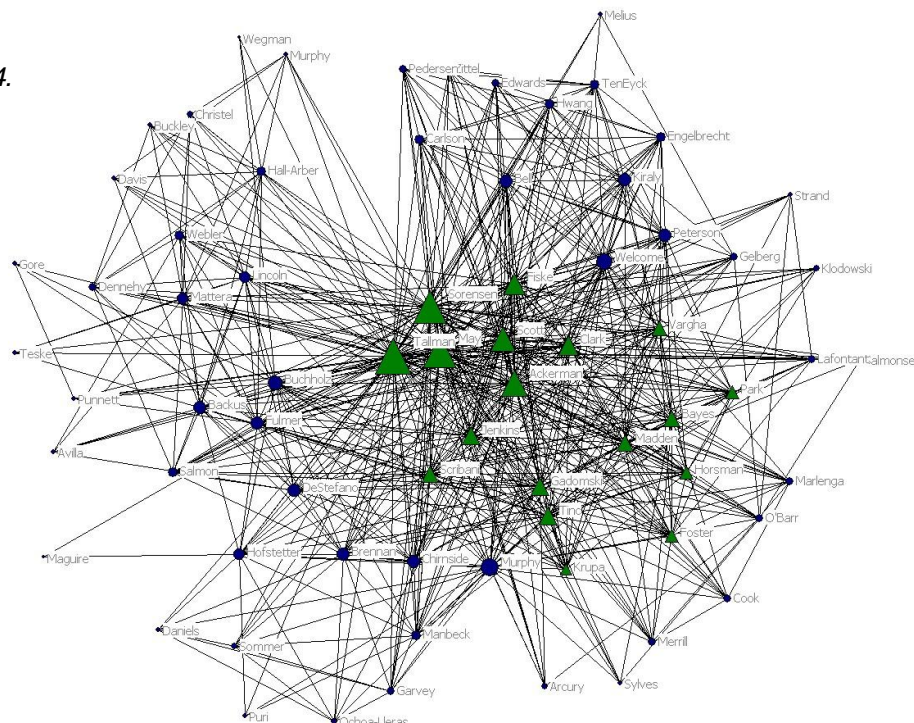
- 5) measuring collaboration and relationships between and among center staff/administration and extramural partners is ongoing using yearly social network analysis (SNA)
- 6) collaborating with other AFF Centers on databases, methods and outputs used in evaluation
- 7) use of a risk/cost/impact/innovation rubric to profile NEC scientific projects and demonstrate their salience
- 8) structuring evaluation methods for NEC Outreach programs
- 9) keeping the scientific project PI's, NEC administration and the Scientific Advisory Panel informed of evaluation results and providing relevant recommendations.
- 10) preparing annual reports, such as this one.

The evaluation team made the following recommendations following the evaluation of the Annual Meeting of scientific project investigators in Saratoga September 24 and 25, 2014:

- NEC should continue to promote engineering solutions that account for human factors.
- NEC expertise in social marketing should continue to be used to increase adoption and implementation of injury prevention interventions.
- Establishing industry partnerships should continue to be a priority to also speed adoption and implementation of injury prevention interventions.
- Continue to link surveillance results with development of injury prevention interventions.
- Poster presentations are a helpful adjunct to annual meetings as they promote discussion and networking among the investigators.
- NEC's future emphasis on fishing and logging is well supported by the injury data as well as participants at this meeting.
- Encourage ties between Ag and fishing researchers in order to translate lessons learned from Ag to fishing sector if possible. Examples include mitigation of toxic gas exposure in confined spaces, tractor stability and fishing vessel stability.

For the 2014 SNA survey, a 93.1% response rate was achieved (67/72 subjects responded). Additions to the roster included the Fishing Advisory Board and Forestry Advisors. Compared to 2013, in 2014 the network has expanded further and become more integrated. There are a larger number of ties and notable changes in the sizes of some nodes throughout the network, indicating a higher level of degree centrality for those nodes. The network is moving towards the desired "wheel" or "circle" shape, as demonstrated in the map below. A slight de-centralization of NEC nodes (green triangles) is seen, suggesting that NEC extramural partners (blue circles) are becoming more integrated with increased interaction with other extramural partners. This would indicate that, over time, the NEC has fostered collaborations throughout the network.

*Social Network  
Map, NEC 2014.*



The following rubric, developed by the evaluation core, focuses on intermediate outcomes and has been updated to reflect developments in the past fiscal year.

	RISK	COST	IMPACT	INNOVATION
<b>On-line Tool</b>	Exposure to hydrogen sulfide*, CO <sub>2</sub> , ammonia, explosive gases, and decreased O <sub>2</sub> *(d/t increased use of gypsum). Risk posed to farmer as well as rescuer.	Multiple fatalities in one incident because rescuer succumbs. Prior software was expensive. Tool allows user to avoid site license fee. Cost associated with maintaining website.	Prior work published in 6 papers. ANSI/ABAE standard now moving online for manure pit ventilation. Website Launched 9/23/14.	Hazard mitigation via pit ventilation. Allows end user to access software at no cost. User friendly and adapted to work for just about any configuration. Could be adapted to fishing holds.
<b>Lobstermen</b>	Lobster line entanglement. Repetitive use injury of hand/wrist (carpal tunnel), back, shoulder and knee.	Wrist/hand, shoulder, back and knee MS injury are being documented.	Lobstermen are state licensed and not included in federal data.	Lobstermen not studied before. Work exposure is being measured. Validated Nordic MS Qu is used to measure injury.
<b>Shields</b>	Machinery entanglements d/t unshielded PTO can lead to amputations, and fatality - One of the top three causes of death on a farm	Amputations and fatality lead to lost farms and productivity. BareCo can offer shield at lower price.	Increase # of shielded PTO and decrease risk of injury. Pre and post shield installation photos.	FFA contest to sell/install shields? Include installation in price of shield. Offer multi-packs of shields with multiple bearings.
<b>Winch</b>	Amputations, entanglements and fatality. Vessel instability or sinking.	Majority of boats do not have shut off within arm's length. Paddle bar on top of	Develop prototype for emergency stop that would reduce winch entanglement.	Multi-component prevention strategy (education, outreach, multiple shut off

	Large turnover of crew, large variety of boat designs. Winch location affects vessel stability.	winch drum to shut it off costs about \$2K. Cost analysis would be helpful.		options, paddle bar) is needed.
<b>Surveillance</b>	Data needed assess risk and trend injury. E coding of external cause of injury or location codes or free text captures risk and injury data.	Compared to doing surveys, this is a lower cost method of collecting data by using existing electronic data.	NIOSH interest. Outpatient data in ME added 17 cases to discovery technique. Trending using existing data.	Bayes data analysis to estimate error rate. Streamlined multiplier possible. Use for other types of injury; NH has interest in translating this model for occ health surveillance.
<b>Tractor Stability</b>	300,000 tractors in use. 100 deaths/year. 3x shorter life for each hour of tractor use. Rear and side overturn.	\$2.5 million estimate per death. \$100 per tractor tilt detector. OEM buy in will lead to large cost savings. Industry investment (Volvo) made in 2014.	Driver alerting system for side overturn. Rear overturn prevention by mechanical intervention.	Tractor driving simulator –tilt cab. Use existing eye and face tracking technology on tractors.

## Feasibility Studies

To address emerging issues in the Agriculture, Forestry, and Fishing sectors, two one-year feasibility studies were funded starting in September 2013. One study focused on assessing fishermen's perceptions of risks related to refrigerant hazards in confined spaces on fishing vessels. This study was conducted with fishermen in various United States fisheries, including in the Northeast, Southeast, Pacific Northwest, and Alaska. Roughly 40% of fishermen interviewed rated the hazard of refrigerants in confined spaces to be equivalent to the risk from radon in a home. The second study evaluated the utility of a fungal bioreactor as an innovative method of removing E. Coli from manure waste storage areas. Potentially promising results have been seen in laboratory models with steady reductions in the numbers of E. Coli colonies in low flow streams over the 28-day study period. Higher flow streams showed delayed decrease in colonies (decreases began after day 21). Future plans include optimizing fungal mixtures and concentrations for maximum E. Coli consumption in both low and high flow streams, and developing practical applications to existing manure storage designs.

Four one-year feasibility studies were awarded funding starting in September 2014. One of the awardees from Virginia Tech has developed a free application for smart phones to be utilized as a tool to track the stability of fishing vessels and record drills. The app continues to be improved and promotion is planned through various channels across the country (AMSEA, Maine Fisherman's Forum, etc). Future plans include translation of the app into several languages, including Vietnamese. A second awardee, from Fishing Partnership Support Services, based in Burlington MA, is conducting in-depth interviews with owners of fishing vessels in the Northeast. These interviews will assess the owners' attitudes surrounding a newly developed hatch monitoring system, will determine the level of interest and feasibility in installing such systems on NE fishing vessels, and will assess the owners' interest in adopting a worksite safety and health program for their crew. The third study is focused on the development and testing of a new lobster claw banding tool to be used in the Northeast lobster fishery. Several prototypes of devices are being tested using electromyography to assess muscle labor load with the new tools compared to the traditional lobster banding tool. In addition, qualitative data on comfort and preference of the tools will be assessed. The final project focuses on the development and sustainment of a national network of partners (the National Tractor Safety Coalition, or NTSC) to facilitate the establishment of a national ROPS program. This project will utilize task forces, a steering committee, web tools, newsletters, and media channels to promote continued collaboration of safety partners in support of the national initiative. In progress towards the national program, the NTSC will aim to secure funding for ROPS, develop a national marketing plan, and will expand current NEC resources (ROPS website and call-in hotline) to accommodate a national program.

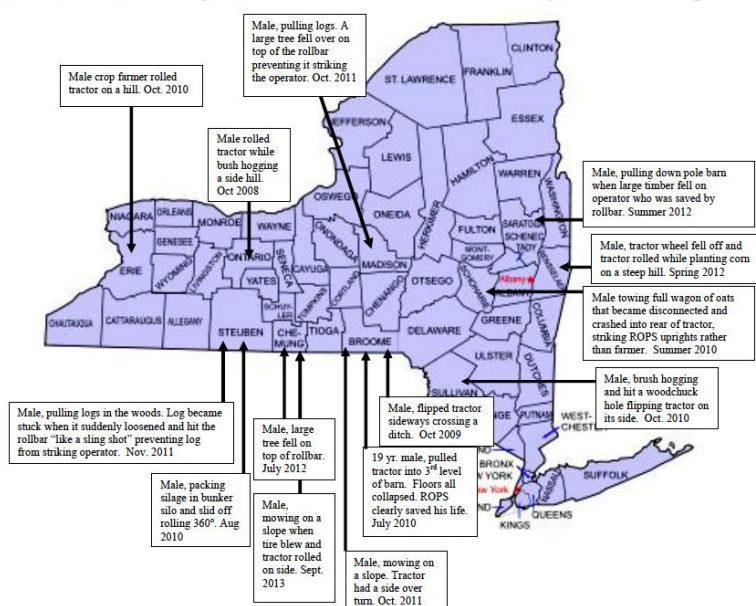
## Other NEC-Related Activities

Though not supported as part of the 2011-2016 NEC funding, two other NIOSH funded projects are functioning as part of the overall NEC initiative and should be mentioned to more clearly describe the overall NEC effort at the New York Center for Agricultural Medicine and Health.

### Tractor Rollover Protection Social Marketing

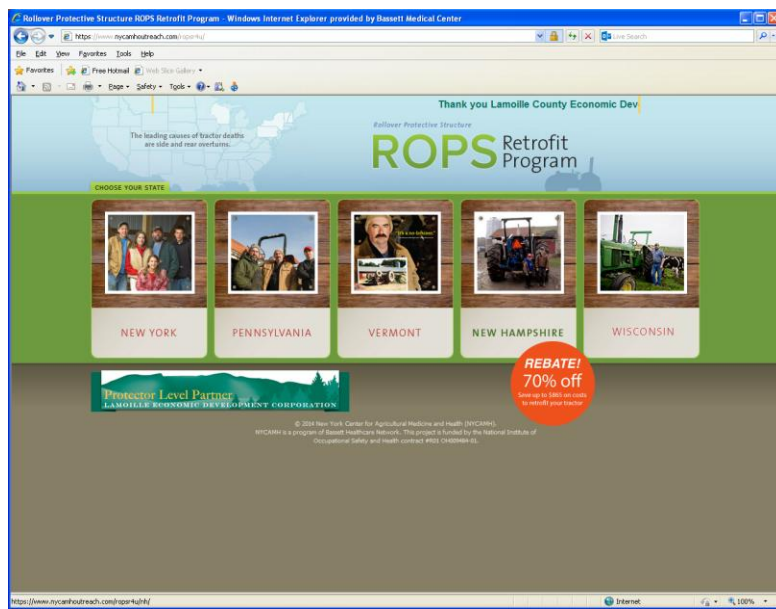
Though no longer funded with NEC dollars, the Northeast ROPS initiative continues to be active, in part with NIOSH support. In New York, the project has continued to benefit from support by the New York legislature. In 2014, the number of retrofits installed through the New York ROPS program has reached more than 1,300, insuring the safety of as many previously at-risk farm families. Follow up survey data has enabled NEC to identify at least 14 cases in which fatalities or serious injuries have been prevented (see map below). Economic analysis of this program demonstrates that it is clearly cost-effective.

Known Serious Injuries / Fatalities Prevented by ROPS Program



Similar programs have also been established in Pennsylvania, Vermont and New Hampshire. These are progressing with variable success based upon local funding availability. In March 2013, the NEC also assisted with the launch of the Wisconsin ROPS program, which utilizes the project hotline and administrative resources that are available in New York, Vermont, New Hampshire and Pennsylvania. At the time of this report, a total of 411 tractors had been retrofitted in the four expansion states (Vermont, New Hampshire, Pennsylvania, and Wisconsin). There is active interest in establishing ROPS programs in other states, as well.





NEC ROPS Retrofit Program website homepage.

### National Tractor Safety Coalition “Whole System in a Room” Conference

Pamela Tinc is a research coordinator for the National Tractor Safety Coalition (NTSC) and one of the organizers for the “Whole System in a Room” conference in May 2014. There were 50 organizations that participated in the conference representing nine unique stakeholder groups (e.g. manufacturers, ag organizations, health and safety organizations, etc.). Each stakeholder group developed three-month and three-year action plans for promoting/enhancing tractor safety in the United States. At the end of the two-day meeting in May, four task force groups were created to tackle immediate and long-term goals. The meeting was cosponsored by the National Institute for Occupational Safety and Health (NIOSH) and the CHS Foundation. (CHS Inc. is an energy, grain and foods company.) Other Ag Centers have been encouraged to join this Coalition. In the future it would be ideal if the Agricultural Centers could support the program by providing personnel to run the ROPS hotline.

Table 1. Scientific Project Outputs and Intermediate Outcomes

Project	Outputs	Outcomes
<b>On-line Tool</b>	Demonstration of on-line simulator tool; User inputs any manure pit configuration on windows-based platform. Alpha and beta testing completed. Trainer's manual available. User's manual is on website. Presented at the 2014 ASABE conference.	Online tool launched 9/23/14. Papers published: Murphy, D.J, Manbeck HB. Confined Space Manure Storage and Facilities Safety Assessment. <i>Journal of Agricultural Safety and Health</i> .
<b>Lobstermen</b>	Most important are the estimates of exposure, i.e. FTEs. Have learned that FTE in ME is 2180 compared to 1502 in MA. Also MS injury. Wrist and hand injuries were the most frequently reported among the cohort, with cuts compromising the majority of these injuries.	<i>Short term:</i> Estimate total occupational exposure and occupationally-related musculo-skeletal morbidity for lobstering. Produce fatality rates for on-shore lobstermen in ME/MA <i>Long term:</i> Knowledge of injury and fatality rates in lobster population; potential for prevention. The relationship between work and injury outcome will be clarified. Begin to explore specific intervention ideas based on likely impact and likely success, e.g. foot operated lobster banding tool. Re-examine process of hauling in lobster.
<b>Shields</b>	Worked with professional advisory board; established inaccuracy of telephone survey to	BareCo PTO shield testing - \$60 each Three papers completed: Chapel et.al. "Validation

	determine shielding rates; conducted farm audits (n=211) in NYS only to look at 1,500 implements in order to identify shielding rate (57% PTO shielded by audit vs. 95% shielded by phone survey). Identified barriers to shielding, identified the "ideal shield" through BareCo. Identified appropriate social marketing messages via focus group discussions. Target launch region for social marketing channels identified (six county region of NYS).	of self-reported power take-off shielding and comparisons of shielding for various farm implements using on-site farm audits." Weil et.al "It's tough to tie your shoes while you're walking." A qualitative analysis of power take-off driveline shields: Barriers and motivators for shield use for New York State farmers". Tinc et al "Concept Identification for a Power Take-Off Shielding Campaign" 2014 ISASH and SHARPS presentations. Social marketing messages finalized (three messages) for dissemination.
<b>Winch</b>	Completed qualitative study of 54 captains which is a baseline survey to identify barriers to intervention (cost, placement and diversity of winch equipment). Majority of all boats had PTO switches. A winch on top of pilot house is a stability hazard. Manual level wind technique is used when winch is located on mid deck.	Article published in Commercial Fisheries News. Backus, A. Winch safety study identifies crew hazards. January 2014 and Winch safety study identifies emergency shutoffs. March 2014
<b>Tractor Stability</b>	Study of roll and pitch perception and risky behavior using a tractor driving simulator. Use alert system for side overturn prevention. Use power cutoff to prevent rear overturn.	IEEE, ASABE 2014 abstract. Open source software. 360 degree tractor driving simulator. \$100 tilt detector. Open access to share development idea led to industry partnership with Volvo research and development.
<b>Surveillance</b>	Data received from ME, NH, NY, NJ (death data). Active requests in VT, MD, NJ (EMS/hospital). Case matching complete in ME and NH between EMS and hospital data. Sensitivity/specificity/ positive predictive power of farm location check-box, identification of common cases between various data sources.	First paper published in Agromedicine. One accepted provisionally for publication in J Agromed. Presented study design and preliminary results at APHA meeting Nov 2013. Established collaborative relationships with various state data agencies. Sharing surveillance methodology with state health departments, other agencies Developed multiplier to correct observed injury rates ME 2008 sens 25%, specificity 99.99%. NH 2008 sens.14%, spec 99.99% NH has expressed interest in collaboration to translate this surveillance method to general occupational injury

Table 2. Cumulative Dissemination of NEC Project Results to date

Category	Details
<b>Published Papers</b>	<p><u>Shields Project:</u> Weil R, Mellors P, Fiske T, Sorensen JA. A qualitative analysis of power take-off driveline shields: barriers and motivators to shield use for New York State farmers. <i>J Agric Saf Health</i> 2014; 20(1):51-61.</p> <p><u>Online Tool Project:</u> Murphy, DJ and Manbeck, HM. Confined Space Manure Storage and Facilities Safety Assessment. <i>J Agri Saf &amp; Health</i> 2014; 20(3):199-210.</p> <p><u>Tractor Stability:</u> Görücü S, Cavallo E, Murphy D. Perceptions of tilt angles of an agricultural tractor. <i>J Agromedicine</i> 2014; 19(1):5-14.</p> <p><u>Surveillance Project:</u> Scott EE, Krupa NL, Sorensen JA, Jenkins PL. Electronic Merger of Large Health Care Data Sets: Cautionary Notes from a Study of Agricultural Morbidity in New York State. <i>J of Agromedicine</i> 2013; 18(4) p.334-339.</p>

	<p><u>Partnerships for a National ROPS Effort Project:</u> Sorensen JA, Brewer DD, Wyckoff L, Horsman M, Scott Erika, May JJ. Building Safety Partnerships Using Social Network Analysis. <i>Social Marketing Quarterly</i> 2013; 19(2):67-75.</p> <p><u>Outreach:</u> Fiske T, Earle-Richardson G. Farm Safety Research to Practice: The Long Road from the Lab to the Farm. <i>J Agromed</i> 2013; 18:11-17. PMID 23301886.</p> <p><u>Multi-state ROPS:</u> Sorensen JA, Jenkins PL, Bayes B, Purschwitz MA, May JJ. Increases in Rollover Protective Structure Pricing from 2006-2012 and the Impact on ROPS Demand. <i>J Agri Saf &amp; Health</i> 2013; 19(2): 115-124. PMID 23923731.</p> <p>Yoder M, Sorensen JA, Foster F, Myers M, Murphy D, Cook G, May J, Jenkins P. Selecting Target Populations for ROPS Retrofit Programs in Pennsylvania and Vermont. <i>J Agri Saf &amp; Health</i> 2013; 19(3):175-190.</p> <p><u>Other:</u> Hodge BD, Gaetano DE, Ackerman SA, Jastremski CA, Fulmer T. Nurses in Occupational Practice in Agricultural and Rural Communities in New York State: Providing Health and Safety Education and Prevention Services. In C.A.Winters &amp; H.J. Lee (Eds.), Rural Nursing : Concepts, Theory, and Practice 2013 Fourth Ed. Chapter 27 (pp. 421-437). New York, NY: Springer Publishing Company.</p> <p>Scribani M, Wyckoff S, Jenkins P, Bauer H, Earle-Richardson G. Migrant and seasonal crop worker injury and illness across the Northeast. <i>Am J Ind Med</i>. 2012; Dec 27. doi: 10.1002/ajim.22150. PubMed PMID: 23280646</p>
<b>Article</b>	<p><u>Winch Project:</u> Article published in Commercial Fisheries News. Backus, A. Winch safety study identifies crew hazards. January 2014 Vol. 41 No. 5</p> <p>Article published in Commercial Fisheries News. Backus, A. Winch safety study identifies emergency shutoffs. March 2014 Vol. 41 No. 7</p>
<b>Papers in Progress</b>	<p><u>Surveillance Project:</u> Scott EE, Krupa NL, Horsman M, Jenkins PL. Estimation of Agricultural and Logging Incidence in Maine Using Electronic Administrative Data Sets. Provisionally accepted, revising. <i>J Agromedicine</i> 2014.</p> <p>New Hampshire paper, in progress. To be submitted September 2014 to <i>Journal of Occupational and Environmental Medicine</i>.</p> <p><u>Shields Project:</u> David Chapel BS, Julie Sorensen PhD, Todd Fiske JD, Sherry Wyckoff MS, Erin Madden, Rebecca Weil, Patrick Mellors BS, Paul Jenkins PhD. Validation of self-reported power take-off shielding and comparisons of shielding for various farm implements using on-site farm audits. <i>Submitted to J Agric Saf &amp; Health</i>. April 2014.</p> <p><u>Tractor Stability Project:</u> State of art review in progress. 2014.</p>
<b>Projected Publications and Deliverables</b>	<p><u>Online Tool Project:</u> On-Line Simulation Package for Designing Ventilation Systems for Confined-Space Manure Pits 2014. <a href="http://www.engr.psu.edu/ventilationdesign">http://www.engr.psu.edu/ventilationdesign</a></p> <p>Standards: Revision of ANSI/ASABE 607, Ventilating Manure Pits to Reduce Entry Risk (2015-2016).</p> <p>Extension Publications: Users Manual for Designing Manure Pit Ventilation System using SWFS (Q2, 2014). Extension Fact Sheets (Q4, 2014).</p>

	<p><u>Lobstermen Project:</u> Work Exposure in Lobstering – preliminary analysis of 4 year prospective study. <i>Paper in process. September 2014</i> Musculoskeletal Disorders in lobstering. <i>Paper in process. October 2014</i></p> <p><u>Shields Project:</u> Tinc PJ, Madden E, Weil R, and Sorensen JA. Concept Identification for Power Take-Off Shielding Campaign. <i>Accepted: August 2014, J of Agromedicine</i>.</p>
<b>Legislative Materials</b>	<p><u>Evaluation and Administrative Cores:</u> Contributed to a collaborative Ag center-wide Capitol Hill leave-behind document promoting the AFF program: provided summary of impact and cost benefit from the NEC multi-state ROPS program. 2013-2014.</p> <p>Developed NEC-specific Capitol Hill leave-behind document: two pages highlighting benefits and impacts of the NEC and its scientific projects. 2013-2014.</p>
<b>Presentations</b>	<p><u>Evaluation Core:</u> Scribani M, Gadomski A, Tallman N, May J. Measuring collaboration: A social network analysis. American Evaluation Association Annual meeting, in Washington, D.C. 10/18/13.</p> <p><u>Online Tool Project:</u> Hofstetter DW, Manbeck HB, Puri VM, and Murphy DJ. An Online Confined-Space Manure Ventilation Design Tool Using SolidWorks Flow Simulation. Presented at the 2014 ASABE Annual International Meeting, in Montreal, QC Canada, 7/13-16/14. ASABE Paper No. 141913912.</p> <p>Murphy DJ, Manbeck HB, Hofstetter DW, and Puri VM. Online Tool for Designing Ventilation Systems to Reduce Manure Pit Entry Risk. Presented at the 2014 NRCS Engineering Technical Update Workshop, in Pennsylvania Furnace, PA, 6/5/14.</p> <p>Hofstetter D, Manbeck H, Puri V, and Murphy DJ. Confined Space Ventilation Modeling Using SolidWorks Flow Simulation. Presented at SolidWorks World 2013 in Orlando, FL, 1/21-23/13.</p> <p>Hofstetter DW, Manbeck HB, Puri VM, and Murphy DJ. Manure Pit Ventilation Modeling using SolidWorks Flow Simulation. Presented at NABEC 2013, in Altoona, PA, 6/16/-19/13. NABEC Poster No. 13-039.</p> <p>Hofstetter DW, Manbeck HB, Puri VM, and Murphy DJ. CFD Simulation of Manure Pit Ventilation using SolidWorks. Presented at the 2013 ASABE Annual International Meeting, in Kansas City, MO, 7/21-24/13. ASABE Poster No. 1621753.</p> <p><u>Surveillance Project:</u> Scott E. New surveillance strategy for farming and forestry injury. American Public Health Association, in Boston, MA, 11/2/13.</p> <p><u>Shields Project (planned presentation):</u> Sorensen JA. Abstracts accepted for presentation at ISASH International Society for Agricultural Safety and Health, in Omaha, Nebraska, 6/22-26/14 and SHARPS Safety and Health in Agricultural and Rural Populations, in Saskatoon, Canada, 10/19-22/14.</p> <p><u>Tractor Stability:</u> Daniels J, Garvey P, Murphy DJ, Sommer HJ, Brennan S, Ochoa Lleras N, Brown AA. GoPro Filming of Driver Behavior While Operating Farm Tractors. 2014 ASABE Annual International Meeting.</p> <p>Ochoa Lleras N, Brown AA, Brennan S, Garvey P, Sommer HJ, Murphy DJ. Development of an open-source Immersive Tractor Driving Simulator. 2014 ASABE Annual International Meeting.</p> <p>Swanson KS, Brown AA, Brennan S, LaJambe C. Extending Driving Simulator Capabilities Toward Hardware-in-the-Loop Testbeds and Remote Vehicle Interfaces. 2013 IEEE Intelligent Vehicles Symposium Workshops.</p> <p>Swanson KS, Brown AA, Brennan S, LaJambe C. Extending Driving Simulator Capabilities Toward Hardware-In-The-Loop Testbeds and Remote Vehicle Interfaces. IEEE IV 2013 Environment Perception and Navigation for Intelligent Vehicles, 6/23/13, Gold Coast, Australia.</p>

	<u>Lobstermen Project:</u> Fulmer S. Preliminary analysis results were presented at the bi-annual UMass-UConn Occ Health Symposium in May, 2013.
<b>Media Coverage</b>	Online Tool: Telephone interviews and one live interview with media outlets including newspapers and NPR.